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【DESCRIPTION】

【Invention Title】

WIND TURBINE

【Technical Field】

The present invention relates, in general, to a wind turbine, and more particularly, to a wind turbine in which a plurality of sail structures are connected by a chain so that power generated in the respective sail structures by wind can be collected to produce electricity, thereby obtaining a great amount of electric energy even from wind with low velocity.

【Background Art】

In general, a wind turbine serves as a device for producing electricity by using wind, which is limitlessly generated on the earth. The wind turbine has at least one rotor which is rotated by a lift induced by a wind force.

The rotor of the wind turbine must have a structure capable of obtaining a lift from a light blast of wind and of reliably rotating while not being damaged by a strong blast of wind. That is to say, the rotor must be manufactured to have a large size to obtain a lift from a light blast of wind and a small size not to be damaged by a strong blast of wind. Thus, the rotor must satisfy these

two conflicting conditions.

A conventional propeller type wind turbine has problems in that it occupies a large volume considering its electricity production capacity. Also, since a rotor, a generator and other parts should be positioned high above the ground, installation costs are high, and it is difficult to conduct repair and maintenance work. Further, the wind turbine can be damaged by exposure to strong wind.

In consideration of the structure of the rotor, in order to produce electricity, a wind velocity of at least 5-6 m/sec must be maintained. Therefore, in such areas where a light wind blows and a wind direction frequently changes, satisfactory electricity production cannot be achieved. Furthermore, due to the fact that the center of gravity of the wind turbine is placed at a substantial height, it is difficult to install the wind turbine on an offshore structure. Moreover, a support column and the rotor are likely to be damaged by heavy winds such as a typhoon or a wind gust.

To cope with these problems, some wind turbines which employ a sail structure similar to a sail provided to a boat have been disclosed in the art. However, these wind turbines also suffer from a defect in that the sail structure is susceptible to damage by strong wind.

【Disclosure】

[Technical Problem]

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a wind turbine which is constructed in a manner such that electricity can be reliably produced even in a region where light wind blows and a wind receiving area can be adjusted to conform with wind intensity to prevent the wind turbine from being damaged due to a typhoon or a wind gust.

[Technical Solution]

In order to achieve the above object, according to one aspect of the present invention, there is provided a wind turbine for producing electricity using wind, the wind turbine including a steel tower which is placed on the ground and formed by fastening a plurality of steel pieces oriented in longitudinal and transverse directions, a support plate which is mounted to the steel tower, power generating means which is installed on the support plate and has a plurality of sail structures, an auxiliary sprocket which is placed on the support plate, is connected to a driving shaft of the power generating means by a power transmitting chain and is rotated by power generated by the power generating means, and a rotation shaft which is connected to the auxiliary sprocket by a driving chain to transmit power to a generator, wherein, in the power

generating means, the driving shaft, a plurality of columns, and a guide shaft are sequentially installed between a base frame which is fastened to the support plate via a plurality of support rods and a cover frame which is positioned above the base frame in such a way as to connect the base frame and the cover frame to each other; a plurality of guide rails, which are regularly spaced apart from one another in a vertical direction, are fastened to the columns to define closed loops which surround the driving shaft, guide shaft and columns; and the plurality of sail structures, each of which can be adjusted in its wind pressure acting area by means of a geared motor and a coil spring, are connected to sprocket chains which are provided in the guide rails such that the sail structures can be moved along the guide rails by wind force to rotate the sprocket chains and sprockets of the driving shaft which are meshed with the sprocket chains, and wherein two power generating means are installed such that they have a predetermined slope and symmetrical structures with respect to a transverse center line of the support plate, to transmit power generated by the driving shaft to the auxiliary sprocket through power transmitting chains.

According to another aspect of the present invention, the sail structure comprises a frame having a plurality of transverse pipes each of which is hingedly coupled to the sprocket chain at one end thereof and a plurality of

longitudinal pipes which connect the transverse pipes with one another in the vertical direction; shaft fastening brackets and connection shaft fastening brackets installed at both ends of the transverse pipes which are positioned along the top and bottom edges of the frame; first sprockets fastened to both ends of a connection shaft which is supported at both ends thereof by the connection shaft fastening brackets; a drum supported at both ends thereof by the shaft fastening brackets; second sprockets installed on fixed shafts which extend upward and downward from both ends of the drum and connected with the first sprockets by chains; the coil spring installed on the fixed shaft which extends through the second sprocket positioned at an upper end of the drum and fastened at one end thereof to the chain which connects the first and second sprockets with each other; the geared motor connected to the fixed shaft which extends through the second sprocket positioned at a lower end of the drum, to rotate the drum; support brackets each having one end fastened to a rear side of the transverse pipe and the other end provided with a plurality of rollers brought into contact with the guide rail; a sail having one end secured to the drum to be wound on the drum, upper and lower sides connected by connection means to the transverse pipes positioned along the top and bottom edges of the frame to be guided by the transverse pipes, and the other end which is provided with a fixing rod for

connecting the upper and lower sides with each other; and connection wires for connecting the fixing rod with the chains, and power supply devices, for supplying power to the geared motor, are installed on the power generating means.

According to another aspect of the present invention, a braking block having a plurality of rollers is installed under a lower surface of the support plate such that the rollers are brought into rolling contact with a circular rail which is installed on an upper end of the steel tower; a driving motor is mounted to the braking block; a braking shaft which is connected to the driving motor by chain gears and a chain is installed on the braking block; and a brake lining which is threadedly coupled to the braking shaft is installed on the braking block to be moved forward and rearward depending upon a rotating direction of the braking shaft to thereby be brought into contact with the circular rail.

According to another aspect of the present invention, the connection means comprises wire ropes installed in the transverse pipes and each having one end which is fastened to the drum and the other end which is fastened to a winding pulley positioned coaxial to the first sprocket via a guide pulley installed at a distal end of the transverse pipe; a plurality of rings hanging on the wire ropes to be moved along the wire ropes in the transverse pipes; and a

plurality of connectors each having one end which is connected to the ring and the other end which projects out of the transverse pipe and is connected with a sail ring provided to the sail, whereby the connection means functions to guide the sail along the transverse pipes.

According to another aspect of the present invention, the connection means comprises a guide block installed on the transverse pipe and defined on a lower or an upper surface thereof with a guide groove which extends in the transverse direction; and a guide member having one end which is fastened to the sail and the other end which has a plurality of projections formed in the shape of zipper teeth and inserted into the guide groove.

According to another aspect of the present invention, a slack prevention part for preventing slack of the sail structure is integrally formed adjacent to a lower end of each guide rail; and a first support roller which rolls on an upper surface of the slack prevention part and a second support roller which rolls in the guide rail are provided to the sail structure.

According to another aspect of the present invention, the power supply device comprises a power supply rail having a shape which surrounds the power generating means, the power supply rail being externally supplied with electric power; and a power supply part having a power supply roller which is brought into rolling contact with

the power supply rail, the power supply part being installed on the sail structure to be moved integrally with the sail structure and thereby supply power to the sail structure.

According to another aspect of the present invention, the wind turbine comprises a plurality of limit switches fastened at regular intervals to the transverse pipe which is positioned along the top edge of the frame; a contact block installed on the chain which connects the first and second sprockets with each other, to be sequentially brought into contact with the limit switches when the sail is wound and unwound and thereby sense an unwound degree of the sail; and a control section for receiving switching signals generated from the limit switches to recognize the unwound degree of the sail and comparing the unwound degree of the sail with a wind pressure which is sensed by wind force sensing means provided with a plurality of limit switches to control the geared motor.

According to still another aspect of the present invention, the wind turbine further comprises a wind direction changing plate installed in front of the two power generating means to change a direction of wind which blows from a front of the power generating means toward the gap between the two power generating means, toward the sail structures which are positioned outside the power generating means.

According to yet still another aspect of the present invention, the wind force sensing means comprises at least one rotation fan which has a plurality of wings and is rotated about a rotation shaft by a wind force; a pump which is connected with the rotation shaft of the rotation fan by a belt and pulleys to pump oil stored in an oil tank using a rotation force of the rotation fan; a cylinder formed in the shape of a vertically extending tube which is filled, from its lower end, with oil supplied from the pump, having a piston which is disposed therein to be raised by supplied oil, and connected at its upper end with a drain pipe; a pressure regulating valve for regulating a pressure of oil supplied to the cylinder by the pump; first and second signal generating blocks connected to the piston by way of a piston rod which is fastened to the piston and a support column which is coupled to the piston rod, to be moved upward and downward integrally with the piston; a weight installed on an upper end of the piston rod to apply a predetermined pressure to the piston; the plurality of limit switches installed on support bars which are installed parallel to the support column, to generate signals depending upon a position of the first and second signal generating blocks when the first and second signal generating blocks are moved; and rollers installed on a quadrangular rod which is installed parallel to the support column, to guide upward and downward movement of the first and second signal generating blocks.

[Description of Drawings]

FIG. 1 is a side view illustrating a construction of a wind turbine in accordance with an embodiment of the present invention;

FIG. 2 is a plan view illustrating a structure of a braking block according to the present invention;

FIG. 3 is a plan view illustrating the construction of the wind turbine according to the present invention;

FIG. 4 is a plan view illustrating a construction of power generating means according to the present invention;

FIG. 5 is a front view illustrating a construction of a sail structure according to the present invention;

FIG. 6 is a plan view illustrating the construction of the sail structure according to the present invention;

FIG. 7 is a cross-sectional view taken along the line A-A of FIG. 6;

FIG. 8 is a plan view illustrating a construction of connection means according to the present invention;

FIGs. 9 and 10 are side and plan views illustrating a construction of another connection means according to the present invention;

FIG. 11 is a front view illustrating a construction of wind direction sensing means;

FIG. 12 is a plan view illustrating the construction of the wind direction sensing means;

FIG. 13 is a front view illustrating a construction of wind force sensing means;

FIG. 14 is a side view illustrating a state in which limit switches constituting the wind force sensing means are installed; and

FIG. 15 is a plan view illustrating a structure for supporting first and second signal generating blocks of the wind force sensing means.

[Best Mode]

Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

FIG. 1 is a side view illustrating a construction of a wind turbine in accordance with an embodiment of the present invention; FIG. 2 is a plan view illustrating a structure of a braking block according to the present invention; FIG. 3 is a plan view illustrating the construction of the wind turbine according to the present invention; FIG. 4 is a plan view illustrating a construction of power generating means according to the present invention; FIG. 5 is a front view illustrating a construction of a sail structure according to the present invention; FIG. 6 is a plan view illustrating the construction of the sail structure according to the present

invention; FIG. 7 is a cross-sectional view taken along the line A-A of FIG. 6; FIG. 8 is a plan view illustrating a construction of connection means according to the present invention; FIGs. 9 and 10 are side and plan views illustrating a construction of another connection means according to the present invention; FIG. 11 is a front view illustrating a construction of wind direction sensing means; FIG. 12 is a plan view illustrating the construction of the wind direction sensing means; FIG. 13 is a front view illustrating a construction of wind force sensing means; FIG. 14 is a side view illustrating a state in which limit switches constituting the wind force sensing means are installed; and FIG. 15 is a plan view illustrating a structure for supporting first and second signal generating blocks of the wind force sensing means. A wind turbine in accordance with an embodiment of the present invention is constructed in a manner such that a pair of power generating means 100 and 100' each of which is provided with a plurality of sail structures 200 are installed on a supporting plate 700, and power generated in the two power generating means 100 and 100' is used to produce electricity.

The power generating means 100 and 100' are fastened to the support plate 700 which is installed on the upper end of a steel tower 600. The steel tower 600 allows the power generating means 100 and 100' to be positioned high above the ground and obtain a greater wind force. The steel

tower 600 is formed by fastening a plurality of steel pieces in longitudinal and transverse directions or may be formed by connecting several steel towers to one another.

The support plate 700 installed on the steel tower 600 functions to support the power generating means 100 and 100' and rotate the power generating means 100 and 100' depending upon a wind direction. Referring to FIGs. 1 and 2, a braking block 710 which has a plurality of rollers 711 is installed under a lower surface of the support plate 700 such that the rollers 711 are brought into rolling contact with a circular rail 610 which is installed on the steel tower 600. A driving motor 712 is mounted to the braking block 710. A braking shaft 716 which is connected to the driving motor 712 by chain gears 713 and 714 and a chain 715 is installed on the braking block 710. A brake lining 717 which is threadedly coupled to the braking shaft 716 is installed on the braking block 710 to be moved forward and rearward depending upon a rotating direction of the braking shaft 716 to thereby be brought into contact with the circular rail 610. Accordingly, if the driving motor 712 is actuated and rotates the braking shaft 716 as a signal is generated by wind direction sensing means 800 which will be described later in detail, the brake lining 717 which is threadedly coupled to the braking shaft 716 is moved forward and brought into contact with a circumferential outer surface of the circular rail 610 to prevent the

rotation of the support plate 700.

The power generating means 100 and 100' generate power using wind. Referring to FIG. 3, the two power generating means 100 and 100' are installed on the support plate 700 such that they have symmetrical structures with respect to a transverse center line S1 of the support plate 700. The pair of power generating means 100 and 100' are fastened to the support plate 700 such that a distance measured between them gradually increases from the front toward the rear.

A wind direction changing plate 1000 is installed in front of and between the two power generating means 100 and 100'. The wind direction changing plate 1000 is fastened to the power generating means 100 and 100' or the support plate 700 to be rotated integrally with the power generating means 100 and 100'. The wind direction changing plate 1000 functions to change a direction of wind which blows from the front of the power generating means 100 and 100' toward the gap between the two power generating means 100 and 100', toward the sail structures 200 which are positioned outside the power generating means 100 and 100', to improve electricity production efficiency. Further, the wind direction changing plate 1000 functions to dampen vibration generated when the sail structures 200 which are positioned on the insides of the power generating means 100 and 100' are abruptly folded by wind.

Since the two power generating means 100 and 100' which have the symmetrical structures are constructed in the same manner, hereafter, description will be given only for a construction of one power generating means.

Referring to FIGs. 1, 3 and 4, in the power generating means 100 and 100', a support frame 101 and a cover frame 102 are provided in a manner such that they are spaced apart from each other in a vertical direction and are held parallel to each other. The support frame 101 is fastened to the support plate 700 by a plurality of support rods 106.

A driving shaft 103, a guide shaft 104 and a plurality of columns 105 are installed between the base frame 101 and the cover frame 102. The guide shaft 104 and the plurality of columns 105 are fixed and connect the base frame 101 and the cover frame 102 with each other, whereas the driving shaft 103 is constructed to be rotatably supported at both ends thereof by the frames 101 and 102. A driving sprocket 107 is arranged below the driving shaft 103. Power transmitting chains 730 and 740 for transmitting power generated by the sail structures 200 are connected to the driving sprocket 107.

A plurality of guide rails 110 are installed on the guide shaft 104 and the plurality of columns 105. As shown in FIGs. 4 and 5, each guide rail 110 has a shape which surrounds the driving shaft 103, the guide shaft 104 and

the plurality of columns 105. The plurality of guide rails 110 are regularly spaced apart from one another in a vertical direction. A sprocket chain 120 is disposed in each guide rail 110, and a sprocket 103' which is meshed with each sprocket chain 120 is installed on the driving shaft 103. A slack prevention part 111 for preventing slack of the sail structure 200 is integrally formed adjacent to the lower end of each guide rail 110.

The plurality of sail structures 200 are fastened at regular intervals to the sprocket chains 120 which are disposed in the guide rails 110, respectively. The plurality of sail structures 200 function to rotate the sprocket chains 120 along the guide rails 110 by a wind force, thereby generating power through the driving shaft 103. Referring to FIGs. 5 and 6, a frame 210 is hingedly coupled to the sprocket chains 120 which are disposed in the guide rails 110, a sail 270 is installed on the frame 210, and a geared motor 250 and a coil spring 260 are provided to allow the sail 270 to be wound and unwound depending upon a wind force.

The frame 201 is composed of a plurality of transverse pipes 211, 212 and 213, each of which is hingedly coupled to the sprocket chain 120, and a plurality of longitudinal pipes 214 which connect the plurality of transverse pipes 211, 212 and 213 with one another. Support brackets 220 for preventing reverse rotation of the frame

210 are installed on the rear sides of the transverse pipes 211, 212 and 213 which are hingedly coupled to the sprocket chains 120. That is to say, as shown in FIG. 6, each support bracket 220 has a substantially L-shaped configuration in a manner such that one end of the support bracket 220 is fastened to the transverse pipe 211, 212 and 213 and the other end of the support bracket 220 is provided with a plurality of rollers 221 which are brought into rolling contact with the outer surface of the guide rail 110. The support brackets 220 ensure reliable movement of the frame 210 by the sprocket chains 120 along the guide rails 110. The support brackets 220 maintain an unfolded state of the frame 210, that is, the sail structure 200, when a wind direction and a moving direction of the frame 210 are the same as each other, and maintain a folded state of the frame 210, that is, the sail structure, when a wind direction and a moving direction of the frame 210 are opposite to each other.

First and second support rollers 218 and 219 are provided to each of the transverse pipes 211, 212 and 213. The first support roller 218 is brought into rolling contact with the slack prevention part 111 of the guide rail 110, and the second support roller 119 is installed in the guide rail 110 to implement rolling movement, whereby it is possible to ensure reliable pivoting movement of the sail structure 200 and prevent the frame 210 from being

slacked downward due to a load applied thereto.

Shaft fastening brackets 215 and connection shaft fastening brackets 216 are installed at both ends, respectively, of the transverse pipes 211 and 212 which are positioned along the top and bottom edges of the frame 210, to extend forward of the sail structure 200. A drum 240 on which the sail 270 is wound is installed on the shaft fastening brackets 215, and a connection shaft 234 is installed on the connection shaft fastening brackets 216.

Concretely speaking, both ends of the drum 240 are supported by the shaft fastening brackets 215, and second sprockets 231 are installed on fixed shafts 241 which extend upward and downward from both ends of the drum 240. The second sprockets 231 are connected with first sprockets 230 by chains 280. The geared motor 250 and the coil spring 260 are respectively installed on the fixed shafts 241 which extend upward and downward through the second sprockets 231.

The coil spring 260 is installed on the fixed shaft 241 which extends through the second sprocket 231 positioned on the upper end of the drum 240. One end of the coil spring 260 is fastened to the chain 280 which connects the first and second sprockets 230 and 231 with each other. The coil spring 260 which is fastened at one end thereof to the chain 280 is lengthened and held in a tensed state.when the geared motor 250 is rotated in a forward direction and

the sail 270 is wound on the drum 240. Thereafter, if the geared motor 250 is rotated in a backward direction, the coil spring 260 is compressed and pulls the chain 280 to unwind the sail 270.

The sail 270 has a plurality of sail rings 272 which are fastened to the upper and lower sides of the sail 270 to be spaced apart from one another by the same interval. The sail rings 272 are connected to the frame 210 by virtue of connection means 300. One end of the sail 270 is fastened to the drum 240, and a fixing rod 271 for connecting the upper and lower sides of the sail 270 with each other is provided to the other end of the sail 270.

Connection wires 290 connect both ends of the fixed rod 271 which is installed at the other end of the sail 270 with the chains 280 which connect the first and second sprockets 230 and 231 with each other, so that the chains 280 can be moved integrally with the sail 270 when the sail is wound on or unwound from the drum 240.

Referring to FIGs. 7 and 8, the connection means 300 functions to connect the frame 210 and the sail 270 with each other and allow the sail 270 to be reliably moved along the frame 210 when the sail 270 is wound on or unwound from the drum 240. To constitute the connection means 300, wire ropes 310 are installed in the transverse pipes 211 and 212 which are positioned along the top and bottom edges of the frame 210. One end of the wire rope 310

is fastened to each end of the drum 240, and the other end of the wire rope 310 is fastened to a winding pulley 233 which is positioned coaxial to the first sprocket 230, via a guide pulley 232 which is installed at the distal end of the transverse pipe 211 and 212. Here, in order to allow the wire ropes 310 installed in the transverse pipes 211 and 212 to be connected to the drum 240 and the winding pulleys 233, side portions of the transverse pipes 211 and 212 are partially cut away to define desired openings.

The winding pulleys 233 are constructed in a manner such that they are installed on the connection shaft 234 both ends of which are supported by the connection shaft fastening brackets 216 provided to the transverse brackets 211 and 212, to be rotated integrally with the first sprockets 230. The drum 240, the first and second sprockets 230 and 231 and the winding pulleys 233 have the same diameter to be rotated at the same rotation ratio.

A plurality of rings 320 hang on the wire ropes 310. One end of each of connectors 330 is connected to each ring 320, and the other end of each of the connectors 330 is connected to the sail ring 272 provided to the sail 270, to connect the sail 270 and the frame 210 with each other. At this time, in order to allow the connectors 330 connected with the rings 320 to be connected to the sail rings 272 at the outside of the transverse pipes 211 and 212, each transverse pipe 211 and 212 is defined with a guide groove

217 which extends in a lengthwise direction.

Referring to FIGs. 9 and 10, there is shown another connection means which is structured in a different way. In this connection means, guide blocks 340, each of which is defined with a guide groove 341, are installed on the transverse pipes 211, 212 and 213, and guide members 350 each having a plurality of projections 351 which are inserted into the guide groove 341 of the guide block 340 are installed on the sail 270. Accordingly, when the sail 270 is wound on or unwound from the drum 240, the sail 270 can be smoothly moved along the frame 210.

In other words, the guide blocks 340 are installed to be positioned on the upper or lower ends of the transverse pipes 211, 212 and 213, and the guide grooves 341 which extend in the transverse direction are defined on the upper or lower surfaces of the guide blocks 340. The guide member 350 has a structure similar to a conventional zipper in that one end thereof is stitched to the sail 270 and the other end thereof is formed with the plurality of projections 351 which have the same shape as the teeth of the zipper. Therefore, when the sail 270 is wound on or unwound from the drum 240, as the projections 351 of the guide member 350 are moved along the guide groove 341 integrally with the sail 270.

In the meanwhile, power supply devices 400 for supplying power to the geared motor 250 are installed on

the power generating means 100 and 100'. Each power supply device 400 comprises a power supply rail 410 and a power supply part 430 which are fastened to the sail structure 200 to supply power to the geared motor 250 of the sail structure 200 which is moved along the guide rails 110. The power supply rail 410 has a shape that surrounds the driving shaft 103, the columns 105 and the guide shaft 104 of the power generating means 100 and 100' and is externally supplied with electric power. The power supply part 430 has power supply rollers 420 which are brought into rolling contact with the power supply rail 410.

In order to control the geared motor 250 and the driving motor 712 depending upon the weather to thereby accomplish optimal electricity producing conditions, the wind turbine according to the present invention is provided with wind direction sensing means 800 and wind force sensing means 500. The wind direction sensing means 800 and wind force sensing means 500 are installed at a location where a wind velocity and a wind direction can be easily sensed in consideration of the place at which the wind turbine is installed.

Referring to FIGs. 11 and 12, the wind direction sensing means 800 comprises a wind direction indicator 810. A first cam plate 830 is attached integrally to the middle portion of a shaft 820 to which the wind direction indicator 810 is connected, to be rotated integrally with

the shaft 820. A first limit switch 840 for generating an electric signal is arranged adjacent to the first cam plate 830. Projecting cams 850 to be brought into contact with the first limit switch 840 are formed on an outer edge of the first cam plate 830.

In the wind direction sensing means 800 constructed in this way, as the support plate 700 is rotated, if the pair of power generating means 100 and 100' oppose wind, the first limit switch 840 and the projecting cam 850 are brought into contact with each other to generate a switching signal. By this signal, the driving motor 712 is actuated to move the brake lining 717 forward to thereby brake the support plate 700.

Referring to FIGs. 13 and 14, the wind force sensing means 500 at least one rotation fan 510 which has a plurality of wings, to be rotated by wind force; a pump 520 which is connected with the rotation fan 510 by a belt 514 and pulleys 512 and 513, to be operated in an interlocked manner with the rotation fan 510 and thereby pump oil stored in an oil tank 530; a cylinder 540 which has a piston 541 vertically disposed therein to be raised by oil discharged from the pump 520 and is connected at its upper end with a drain pipe 542 which in turn is connected with the oil tank 530; a pressure regulating valve 570 for regulating a pressure of oil supplied to the cylinder 540 by the pump 520; first and second signal generating blocks

551 and 552 which extend parallel to a piston rod 543 of the piston 541 and are installed on a support column 550 coupled to the piston rod 543, to be moved upward and downward integrally with the piston 541; and a plurality of limit switches 581, 582, 583, 591, 592 and 593 which are installed on support bars 560 which are installed parallel to the support column 550, to generate signals depending upon a position of the first and second signal generating blocks 551 and 552 when the first and second signal generating blocks 551 and 552 are moved, to thereby sense a wind force.

Since the rotation fan 510 is rotated only by wind force without using a separate power source, a rotational velocity of the rotation fan 510 is determined by the wind force, and operation velocity of the pump 520 which is operated while being connected with the rotation shaft 511 of the rotation fan 510 via the belt 514 and the pulleys 512 and 513 is determined depending upon a rotational velocity of the rotation fan 510.

The pulley 512 which is installed on the rotation shaft 511 has at least two pulley grooves so that the pulley 512 can be connected to at least two pumps.

An amount of oil which is discharged by the pump 520 and introduced into the cylinder 540 is determined depending upon a rotational velocity of the rotation fan 510 and an establishment value of the pressure regulating

valve 570. As oil is introduced into the cylinder 540, the piston 541 is raised in the cylinder 540. By this fact, the piston rod 543 of the piston 541 and the first and second signal generating blocks 551 and 552 which are connected to the support column 550 are raised by a distance through which the piston 541 is moved upward.

A weight 544 is installed on the upper end of the piston rod 543. When a rotational velocity of the rotation fan 511 is reduced as a wind force decreases, the weight 544 applies a predetermined pressure to the piston 541 to allow the oil introduced into the cylinder 540 to be discharged through the pressure control valve 570 into the oil tank 520, to thereby lower the piston 541.

The unexplained reference numeral 531 designates a filter.

In order to ensure that the piston rod 543 and the first and second signal generating blocks 551 and 552 which are installed on the support column 550 are smoothly moved upward and downward along with the piston 541, as shown in FIG. 15, a quadrangular rod 553 is installed adjoining the support column 550 to extend parallel to the support column 550. Rollers 554 which are installed on the quadrangular rod 553 are connected to the first and second signal generating blocks 551 and 552, in a manner such that the rollers 554 can be moved on the quadrangular rod 553 when the first and second signal generating blocks 551 and 552

are moved upward and downward, to support the first and second signal generating blocks 551 and 552.

Also, rollers 554' which have the same structure as the rollers 554 are installed to connect the upper end of the support column 550 and the quadrangular rod 553 with each other to guide the movement of the support column 550.

Depending upon a position of the first and second signal generating blocks 551 and 552 which are moved integrally with the piston 541, the limit switches installed on the support bars 560 generate signals.

While the first and second signal generating blocks 551 and 552 are installed on the support column 550 so that they can be moved integrally with the support column 550, they respectively face opposite directions and have distal ends which are inclined in opposite directions, and the limit switches 581, 582 and 583 are operationally related to the first signal generating block 551 and the limit switches 591, 592 and 593 are operationally related to the second signal generating block 552.

As described above, due to the fact that the first and second signal generating blocks 551 and 552 are installed to face opposite directions and have distal ends which are inclined in opposite directions, when the piston 541 is moved upward, the first signal generating block 551 is brought into contact with the limit switches 581, 582 and 583 to generate signals for winding the sail 270, and

when the piston 541 is moved downward, the second signal generating block 552 is brought into contact with the limit switches 591, 592 and 593 to generate signals for unwinding the sail 270. The signals generated by the respective limit switches are transmitted to a control section 900.

If a signal is generated by the uppermost limit switch 583, it means that heavy wind such as a typhoon or a wind gust is blowing. Therefore, in this case, the sail 270 is fully wound on the drum 240, and oil introduced into the cylinder 540 is discharged into the oil tank 530 through the drain pipe 542.

Further, as shown in FIGs. 6 and 14, a plurality of limit switches 201a, 201b, 201c and 201d for sensing an unwinding degree of the sail 270 are installed at regular intervals on the transverse pipe 211 which constitutes the frame 210 which in turn constitutes the sail structure 200. A contact block 202 is installed on the chain 280 to be sequentially brought into contact with the plurality of limit switches 201 when the sail 270 is wound on or unwound from the drum 240. Switching signals 201 which are generated by the limit switches 201 are transmitted to the control section 900.

As a consequence, as the control section 900 controls the geared motor 250 depending upon a wind force determined using the switching signals generated in the limit switches 581, 582, 583, 591, 592 and 593 which are provided to the

wind force sensing means 500 and the limit switches 201a, 201b, 201c and 201d which are provided to the sail structure 200, it is possible to reliably produce electricity without causing breakage of the sail structures 200.

Hereafter, operation of the wind turbine constructed as mentioned above will be described in detail.

When wind blows, the wind turbine according to the present invention receives a wind force through the sail structure 200. By this fact, the power generating means 100 and 100' which are provided with the plurality of sail structures 200 rotate due to the presence of the support plate 700 and the circular rail 610 in the same direction as the wind blows. At this time, as the driving motor 712 is actuated by a signal generated by the wind direction sensing means 800, the brake lining 717 is squeezed against the circular rail 610 to prevent the rotation of the support plate 700.

The sail structures 200 which are positioned outside the power generating means 100 and 100' are held by the support brackets 220 in an unfolded state to receive the wind force, and, conversely, the sail structures 200' which are positioned on the insides of the power generating means 100 and 100' are rotated about a hinge point P and held in a folded state.

If the wind force acts on the plurality of sail

structures 200 which are held in the unfolded state outside the power generating means 100 and 100', the sail structures 200 are pushed rearward and moved along the guide rails 110. At this time, since the plurality of sail structures 200 are connected with one another by the sprocket chains 120, the driving shaft 103 which is meshed with the sprocket chains 120 is rotated.

If the driving shaft 103 is rotated, the auxiliary sprocket 720 which is connected with the driving shaft 103 by the power transmitting chains 730 and 740 is rotated. The auxiliary sprocket 720 which is connected to the rotation shaft 760 by the driving chain 750 rotates the rotation shaft 760. The auxiliary sprocket 720 is connected to the driving shafts 103 which are respectively provided for the two power generating means 100 and 100' to collect power generated in the respective power generating means 100 and 100' and transmit the collected power to the rotation shaft 760.

As the rotation shaft 760 is rotated by the power transmitted thereto, power is transmitted to a generator 790 through a bevel gear 770 meshed with the rotation shaft 760 and a step-up gear 780, so that electricity can be produced.

The wind pressure acting area of the sail 270 provided to the sail structure 200 is adjusted depending upon a magnitude of a wind force, in that it is wound on or

unwound from the drum 240. Namely, when wind intensity changes, the wind force sensing means 500 senses the change and generates stepwise electric signals depending upon a wind force. As the control section 900 combines these signals and the signals generated from the limit switches 201 provided to the sail structure 200, the geared motor 250 for rotating the drum 240 is controlled in its operation in conformity with the intensity of wind.

As an example, if a wind force increases with the sail 270 fully unwound from the drum 240 and thereby a rotational velocity of the rotation fan 510 increases, because an amount of oil supplied to the cylinder 540 by the oil pump 520 increases, the piston 541 is moved upward. By this upward movement of the piston 541, the first and second signal generating blocks 551 and 552 are also moved upward. At this time, the first limit switch 581 is brought into contact with the first signal generating block 551 to generate a signal, and this switching signal is transmitted to the control section 900 to actuate the geared motor 250 to wind the sail 270.

After the sail 270 is wound to a predetermined degree, the contact block 202 which is provided to the chain 280 is brought into contact with the limit switch 201b which is provided to the sail structure 200. At this time, the limit switch 201b transmits a switching signal generated by sensing a wound state of the sail 270 to the

control section 900. Then, the control section 900 interrupts operation of the geared motor 250 so that electricity can be continuously produced with the sail 270 partially unwound from the drum 240.

While it was described in the preferred embodiment that the four limit switches 201 are installed on the sail structure 200, a person skilled in the art will readily recognize that the present invention is not limited to this concrete number of limit switches, and more or fewer limit switches can instead be used as desired by a user.

If an intensity of wind further increases, as an increased amount of oil is supplied to the cylinder 540, the piston 541 and the first and second signal generating blocks 551 and 552 are further moved upward. At this time, the first signal generating block 551 is sequentially brought into contact with the second and third limit switches 582 and 583 which are positioned above the first limit switch 581, to generate a signal for further winding the sail 270. By these signals, the sail 270 is wound on the drum 240. At this time, the wire ropes 310 are also wound along with the sail 270.

If the sail 270 is wound in this way, the chains 280 which are coupled to the fixing rods 271 by the connection wires 290 are rotated in a direction in which the coil spring 260 is tensed.

In this way, when an intensity of wind increases as

the sail 270 is wound on the drum 240, a wind pressure acting area is reduced. Thereafter, if an intensity of wind decreases again, the geared motor 250 is rotated in the backward direction by the signal from the wind force sensing means 500. At this time, the coil spring 260 pulls the chain 280, and as the chain 280 pulls the fixing rod 271 through the connection wire 290, it is possible to unwind the sail 270 to increase a wind pressure acting area.

[Industrial Applicability]

As apparent from the above description, the wind turbine according to the present invention provides advantages in that electricity can be reliably produced using a plurality of sails even in a region where a light wind blows, an increased amount of electricity can be produced under the same wind blowing conditions, and a wind pressure acting area is automatically adjusted to conform with wind intensity to prevent the wind turbine from being damaged due to a typhoon or a wind gust.

Although a preferred embodiment of the present invention has been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.